

FDACS# 10524
Year-3Report (Dec. 2005 to Dec. 2006)
To Florida Department Agriculture and Consumer Services
(FDACS Project Administrator, Mr. Ken Kuhl)

This annual report for Dec. 2005 to Dec. 2006 contains reports for vegetables, forage/agronomic crops, and pines (IFAS Project Coordinators, Cheryl Mackowiak/George Hochmuth)

The 2005/2006 season was one of changes and challenges. Dr. Hochmuth stepped down as project coordinator to take on the duties of IFAS Assistant Dean of Research. Dr. Cheryl Mackowiak took over the role of project coordinator in July and Dr. Eric Simone became the vegetable BMP lead for this grant. Mr. Cliff Starling resigned his position as BMP coordinator in June and Ms. Randi Randell accepted the position at the end of July. Dr. Patrick Minogue became the new NFREC Forestry specialist in November and he will lead the forestry BMP efforts at Live Oak.

When farm manager Mr. Scott Kerr, resigned to accept a position in Suwannee county extension, Ms. Lei Lani Davis became coordinator of farm operations and Ms. Randi Randell moved into the position of center research coordinator which puts farming, BMPs, and research under a single leader. The new management structure should stream-line and advance support of BMP demonstration efforts at the center.

A newly automated, center pivot covering approximately 16 acres was purchased and installed in July, using funds from this grant (Fig. 1). The pivot will support irrigation BMP demonstrations for agronomic and vegetable crops. There is growing interest in producing potatoes, carrots and other vegetables in rows under pivot. The existing pivot which covers approximately 7.5 acres, was moved to the Lake field and was upgraded (Fig. 1). This pivot will primarily support forage BMP demonstrations and studies. Both pivots also have the potential capability of being used to simulate dairy forage production if a liquid fertilizer nurse tank and pump is added.

With the advent of the new and renovated pivot systems and renewed interest in agronomic crops (row crops), it has been added as another commodity to the BMP demonstration efforts at Live Oak. The agronomic crop commodity group was combined with the forage commodity group, which is now called Forage and Agronomic Crops. A meeting with FDACS representatives, IFAS researchers and county faculty is taking place at the end of this funding cycle to review the BMP history at Live Oak and to develop a long-term road map in order to assure that BMP work at this center continues to fulfill the regional and state BMP development needs.

Meanwhile, the center continues to strengthen its reputation as a place to learn about agricultural BMPs. Touring groups in 2006 included US Congressman Boyd and staff, congressional aids/Farm Bureau, and we were host to the state FFA environmental education contest. Additionally, we held a BMP/NOI signup workshop series in November and continue the monthly Suwannee River Partnership breakfasts where participants share what is happening in the Suwannee Valley BMP arena.

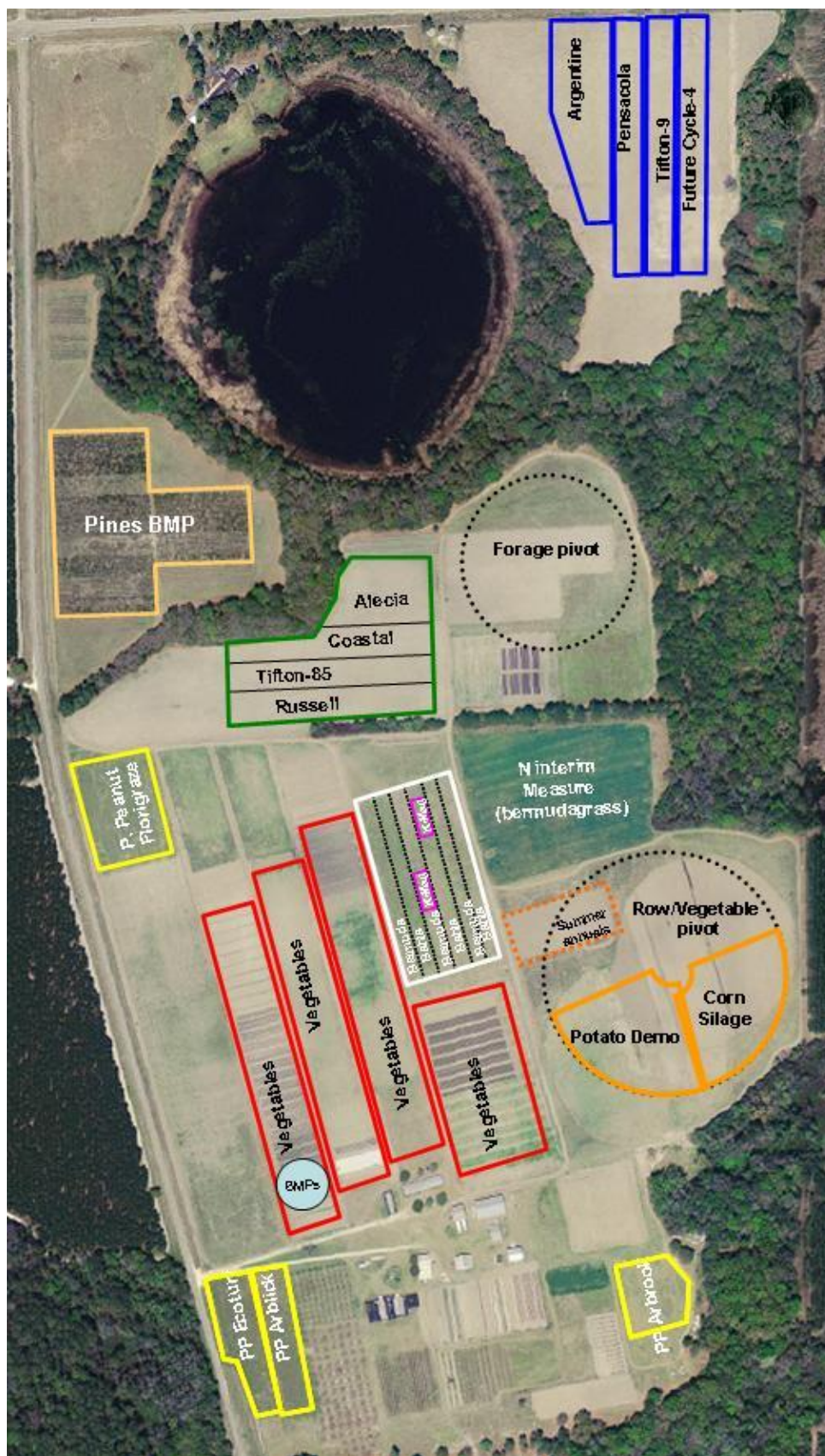


Fig. 1. Locations where BMP-related demonstrations occurred in 2006

VEGETABLES

Co-principal investigators: George Hochmuth, Eric Simonne, Cliff Starling, Bob Hochmuth, Steve Olson, Randi Randell

Project 1. Irrigation programs for watermelon production.

Objective: To evaluate several approaches to determining irrigation management for watermelons on plastic mulch and drip irrigation.

Results: This demonstration indicated that scheduling irrigation based on crop growth as with the Portable TDR and farmer systems worked better than a fixed irrigation schedule.

Treatments (2 replicates):

1. Portable TDR based irrigation
2. 18 days at 30 minutes twice/day, 18 days at 45 minutes twice/day, and 18 days at 1 hour/day. (Farmer program)
3. Fixed data logger TDR

Table 1. Watermelon yield in response to irrigation scheduling treatments, Live Oak, S2006.

Harvest	Treatment	Yield (cwt/A)
1	TDR	288.315
1	Farmer	271.441
1	Datalog	405.741
2	TDR	233.421
2	Farmer	281.489
2	Datalog	96.5435
3	TDR	72.3096
3	Farmer	122.196
3	Datalog	68.8663
Season	TDR	594.046
	Farmer	675.126
	Datalog	571.15

Project 2. Effect of N rate and irrigation level on eggplant yield, Live Oak, S2006.

Objective: To determine interactions of nitrogen fertilizer rate and irrigation level for effects on eggplant yield. Experiment was a 3X3 factorial with 3 replications.

IRRIGATION PROGRAM RUN LENGTH, FREQUENCY, MONITORING:

4-7-06 Water was put on timer.

15 min. 8:00 AM 15 min. 3:45 PM

4-14-06 Water was lowered to 13 mins. 8:00 AM and 3:45 PM

4-24-06 changed to 11 mins.

5-2-06 changed to 13 mins.

5-5-06 changed to 15 mins.

5-15-06 23 mins.

After 5/15/06 remained at 23 mins. Timer was set for 8 AM, 2 PM, and 8 PM. Checked two times per day with a hand held TDR. Kept at an average of 10 cbs for IFAS BMP irrigation treatment.

Irrigation amounts achieved by using multiple 2X and 3X drip tubes per plot.

Results: Early yield was not impacted by N rate but was increased with greater irrigation amounts. Over the long harvesting season (11 harvests), yield was improved with greater nitrogen rate and irrigation amounts.

Table 2. Effect of N rate and irrigation amount on eggplant yield, S 2006, Live Oak, FL.

Treatment		Early yield First 3 harvests	Total yield 11 harvests
Nrate	Irrigation		
IFAS	BMP	150	850
	2X	186	1150
	3X	216	1150
2X IFAS	BMP	164	1400
	2X	206	1286
	3X	213	1463
3X IFAS	BMP	146	1489
	2X	177	1522
	3X	224	1645
	Interaction	NS	NS
Irrigation	BMP	154	1246
	2X	189	1320
	3X	218	1420
	F-test	**	*
Fertilizer	IFAS	184	1050
	2X	195	1383
	3X	182	1552
	F-test	NS	**

Project 3. 'Tami G' Grape Tomato Response to Nitrogen Rates in 2005 and 2006

Eric Simone, Cliff Starling

Grape tomatoes have recently gained in popularity among consumers because they can be eaten without being cut, they are deep red in color, and their flavor is intense. Together with the 40,000 acres of round tomato grown in Florida, it is estimated that grape tomatoes are grown on 3,000 acres. Production recommendations and practices used for grape tomato are similar to those for round tomato (Olson et al., 2005). Typically, grape tomatoes are grown with plasticulture (raised beds, polyethylene-mulched beds spaced 6-ft apart) using transplants, and picked at the full-red stage to ensure high quality (Roberts et al., 2002). In Florida, plants are irrigated using drip or seepage irrigation (management of a perched water table). Because current grape tomato varieties are indeterminate, grape tomato may be grown for up to six months (Simonne et al., 2006). Hence, grape tomatoes require taller stakes (8-ft tall), are tied 6 to 8 times, and need hedging to control vigor. Fertilization may also need to be adjusted. Current base recommendation for tomato production in Florida is 200 lbs/A of N, and is based on soil test for P and K (Olson et al., 2005). When fertigation is possible, 20% to 40% of the N and K should be applied broadcast incorporated in the bed, together with 100% of the P. The remaining N and K₂O may be injected daily or weekly at daily rates of 1.5, 2.0, 2.5, 2.0 and 1.5 lb/A/day for 1-2, 3-4, 5-11, 12, and 13 WAT (Olson et al., 2005).

As an attempt to make up for long growing seasons (up to 24 weeks), growers often use N rates in excess of the base recommended rate for round tomato. Growers also believe that high N rates help maintain grape tomato soluble solid content high, thereby increasing quality. However, Best Management Practices for vegetables encourages growers to follow recommendations as an attempt to reduce the environmental impact of vegetable production on surface and ground water quality (FDACS, 2006). The objectives of this project were to (1) determine N requirement for drip-irrigated grape tomato, and (2) assess the effect of N rate on grape tomato fruit quality.

Materials and Methods

Six-week-old 'Tami G' transplants were established on March 23, 2005 and 4 Apr. 2006 (0 week after transplanting, WAT) at the North Florida Research and Education Center - Suwannee Valley near Live Oak, FL on a Lakeland fine sand (Table 1). Tomatoes were grown on plasticulture on beds spaced 5-ft apart and at a 1.5-ft within row spacing. Fertilization treatments consisted of 0%, 33%, 66%, 100%, 133%, and 166% of the current base recommended rate for round tomato (210 lbs N/A) in 2005. Three additional injections were made in 2006 which raised the total N rate of the 100% treatment to 270 lbs/A. Treatments were 0, 70, 140, 271, 280 and 350 lbs N/A in 2005 and 0, 89, 178, 270, 359, and 448 lbs N/A in 2006, and were created by applying 25% of N and K₂O broadcast preplant in the bed and eight (in 2005) or eleven (in 2006) identical weekly injections of the remaining N from 3 to 10 WAT in 2005 and from 3 to 13 WAT in 2006 (Table 1). This corresponded to daily injection rates of 3 lbs/A of N for the 100% N rate. Phosphorus and K rates were based on soil test results and were constant for all treatments. Modifications of the drip irrigation system allowed for independent fertilizer injections to plots receiving the different N rates. Each plot was 20-ft long and was planted in yellow 'Honey Bunch' plants that were not used for data collection. Marketable yield, culls and soluble solid content were collected on two red 'Tami G' plants grown in the middle of each plot. Interplanting a yellow and a red variety allowed for the establishment of relatively large plots while minimizing labor needed for harvest. Tomatoes were staked to a 8-ft height and strung five times. Irrigation was applied daily based on plant stage of growth in order to

maintain soil water tension at the 30 cm depth between 8 (field capacity) and 15 kPa (Simonne et al., 2006). Other cultural practices followed current recommendations (Olson et al., 2005).

Plants were harvested weekly at the red stage on 10, 17, 24 June and 7 and 15 July (11 to 16 WAT) in 2005 and on 2, 8, 15, 21, 28 June and 6 and 13 July (8 to 14 WAT) in 2006. Each year, the last harvest also included partially ripe fruits. At each harvest from both years, 3 representative tomatoes from each plot were cut in halves and crushed with a garlic press. The juice was placed on the prism of a handheld refractometer for the determination of soluble solid concentration (SSC).

Each year, the experimental design was a randomized complete block design with four replications. Marketable yield and SSC responses to N rates were determined using regression analysis (SAS, 2001). Maximum cumulative yield for each harvest and the corresponding N rate were calculated using the regression equations.

Results and Discussion

Spring 2005 and 2006 were typical warm and dry springs in North Florida. The last harvest was done on 16 and 14 WAT in 2005 and 2006, respectively. Total marketable yield for the 100% treatments were 28,700 and 33,623 lbs/A in 2005 and 2006, respectively. These numbers illustrate the ranges in growing season and seasonal marketable yields. Because treatments were different each year (0, 70, 140, 210, 280 and 350 lbs N/A in 2005 and 0, 89, 178, 270, 359, and 448 lbs N/A in 2006), cumulative marketable grape tomato yield response to N rate was analyzed by year. In 2005, grape tomato marketable yield responses to N rates were linear for harvest 1 and 2 ($p=0.34$), and quadratic for other harvests (Fig. 1). In 2006, yield response to N rate was not significant for harvests 1 to 3, and was quadratic for other harvests (Fig. 4). Because yield was measured on only two plants in each plot, variability was high (CV for cumulative weekly marketable yields ranged between 27% and 59% in 2005 and 31% and 58% in 2006). Each year, culls represented less than 10% of marketable yield and were primarily due to fruit split. Regression equation parameters were used to calculate the N rate resulting in highest cumulative grape tomato marketable yields (Table 2). These results suggest that the injection schedule used supplied more than adequate N at the beginning of the season (no response to N injected for 2 to 3 harvests). Highest seasonal yield in 2005 was reached at a N rate greater than the 100% rate (382 lbs/A of N), but was reached with a N rate lower than the 100% rate (244 lbs/A of N) in 2006. These results illustrate the year-to-year variability (overall yield were lower in 2005 than 2006) and support the need for a range for variable weekly injection rates.

For both years, N rate effect on SSC was overall not significant (p -values ranging between 0.23 and 0.46; CV ranging between 7% and 15%). Mean SSC values were 7, 6.6, 6.9, 7.1, 6.1, n/a and n/a in 2005 and 8.3, 8.2, 8.1, 7.3, 8.0, 7.1 and 7.0 °Brix in 2006, for harvests 1 to 7, respectively. On harvest 5 in 2005, SSC ranged from 5.4 to 6.8 °Brix but response did not follow related to N rates. Mean SSC did not increase or decrease as the season progressed. These results suggest that N rate has a limited effect on SSC. Factors such as variety (Molinar and Yang, 2003) and ripeness (Roberts et al., 2002) may be more important for grape tomato quality. These results do not support the growers' claims that greater N rates result in greater SSC.

Fertigation recommendations for tomato grown in Florida are based on crop stage of growth. In this trial, injection rates were 3 lbs/A/day for all injections. The lack of yield response to N rates for the first two harvests of both years suggest that a 3 lb/A/day rate was unnecessarily high at that time. It could be replaced by the current schedule for round tomato from 0 to 10 WAT

(which reaches 2.5 lb/A/day on 5 WAT). Highest yields on the latest harvests with the 133% and 166% N rates in 2005 suggest that grape tomato may require up to 3 lb/A/day of N to maximize yields during that period. This proposed schedule (Fig. 3) should be used with grape tomato grown in the Spring with plasticulture and needs to be fine tuned in a validation study under controlled irrigation scheduling.

Literature Cited

- FDACS, 2006. Water Quality/Quantity Best Management Practice for Vegetable and Agronomic Crops Manual, 179 pp. Florida Dept. of Agric. and Consumer Serv., [http:// www.floridaagwaterpolicy.com](http://www.floridaagwaterpolicy.com).
- Molinar, R.H. and M. Yang. 2003. Fresno county grape tomato variety trial. http://www.sfc.ucdavis.edu/research/FRESNO_COUNTY_GRAPE_TOMATO_VARIETY_TRIAL_REPORT.pdf (accessed October 20, 2004).
- Olson, S.M., D.N. Maynard, G.J. Hochmuth, C.S. Vavrina, W.M. Stall, M.T Momol, S.E. Webb, T.G. Taylor, S.A. Smith, and E.H. Simonne. 2005. Tomato production in Florida, pp. 357-375 In: S.M. Olson and E. Simonne (Eds.) 2005-2006 Vegetable Production Handbook for Florida, Vance Pub., Lenexa, KS.
- Roberts, K.P., S.A. Sargent, and A.J. Foxx. 2002. Effects of storage temperature on ripening and postharvest quality of grape and mini-pear tomatoes. Proc. Fla. State Hort. Soc. 115:80-84.
- SAS. 2001. SAS/STAT user's guide, Ver. 8.2, SAS Institute, Cary, NC.
- Simonne, E., S.A. Sargent, D. Studstill, A. Simonne, R. Hochmuth, and S. Kerr. 2006. Field performance, chemical composition and sensory evaluation of grape tomato varieties. Proc. Fla. Hort. Soc. 119:376-378.

Table 1. Fertigation and harvest schedules for grape tomatoes grown with plasticulture at the North Florida Research and Education Center –Suwannee Valley, near Live Oak, FL in the Springs of 2005 and 2006.

Practice	PP ^z	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Season
Fertilization 2005 ^y (lbs/A)	50				20	20	20	20	20	20	20	20							210
Fertilization 2006 ^y (lbs/A)	50				20	20	20	20	20	20	20	20	20	20	20				270
Harvest 2005													H1	H2	H3		H4	H5	5
Harvest 2006										H1	H2	H3	H4	H5	H6	H7			7

^z PP = preplant fertilizer; WAT = 0 on 23 Mar. 2005 and 4 Apr. 2006. Last harvests were 15 and 13 July in 2005 and 2006, ^y respectively.

Fertilization: for the 210 lbs/A of N treatment. Fertilization injections made with ammonium nitrate and potassium chloride

Total N fertilization: 210 and 270 lbs N/A in 2005 and 2006, respectively. Treatments were 0, 70, 140, 271, 280 and 350 lbs N/A in 2005 and 0, 89, 178, 270, 359, and 448 lbs N/A in 2006.

Table 2. N-rate corresponding to predicted cumulative maximum yield by regression equations from Fig. 1 and 2.

Harvest	2005		2006	
	Max Yield (lbs/A)	N-rate (lbs/A)	Max Yield (lbs/A)	N-rate (lbs/A)
H1	n/a	n/a	n/a	n/a
H1-H2	n/a	n/a	n/a	n/a
H1-H3	18,321	241	--	n/a
H1-H4	31,536	309	18,449	217
H1-H5	40,370	382	25,454	215
H1-H6	--	--	33,637	231
H1-H7	--	--	36,873	244

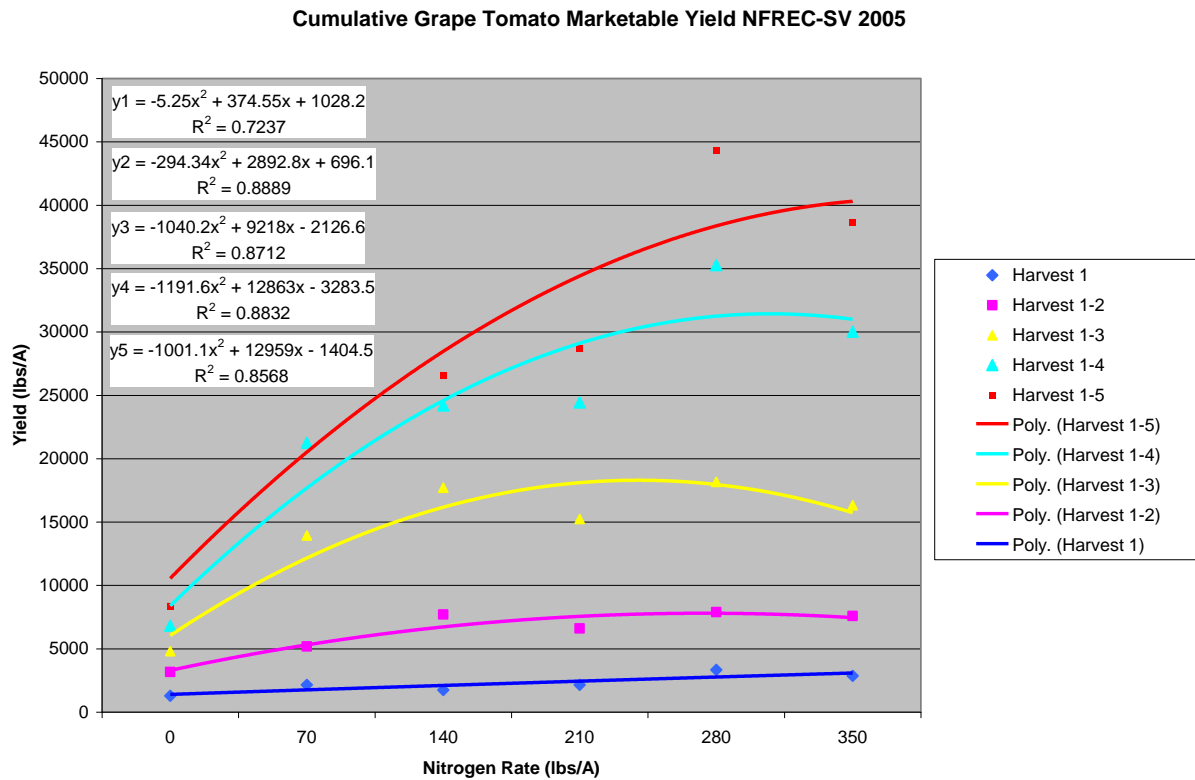


Fig. 1. Marketable yield (lbs/A, 5 harvests cumulated) response of ‘Tami G’ grape tomato grown with plasticulture in the Spring of 2005 at the North Florida Research and Education Center- Suwannee Valley, near Live Oak, FL, to nitrogen rates (y1 to y5 represent cumulative yields from up to harvest 1, to up to harvest 5, respectively).

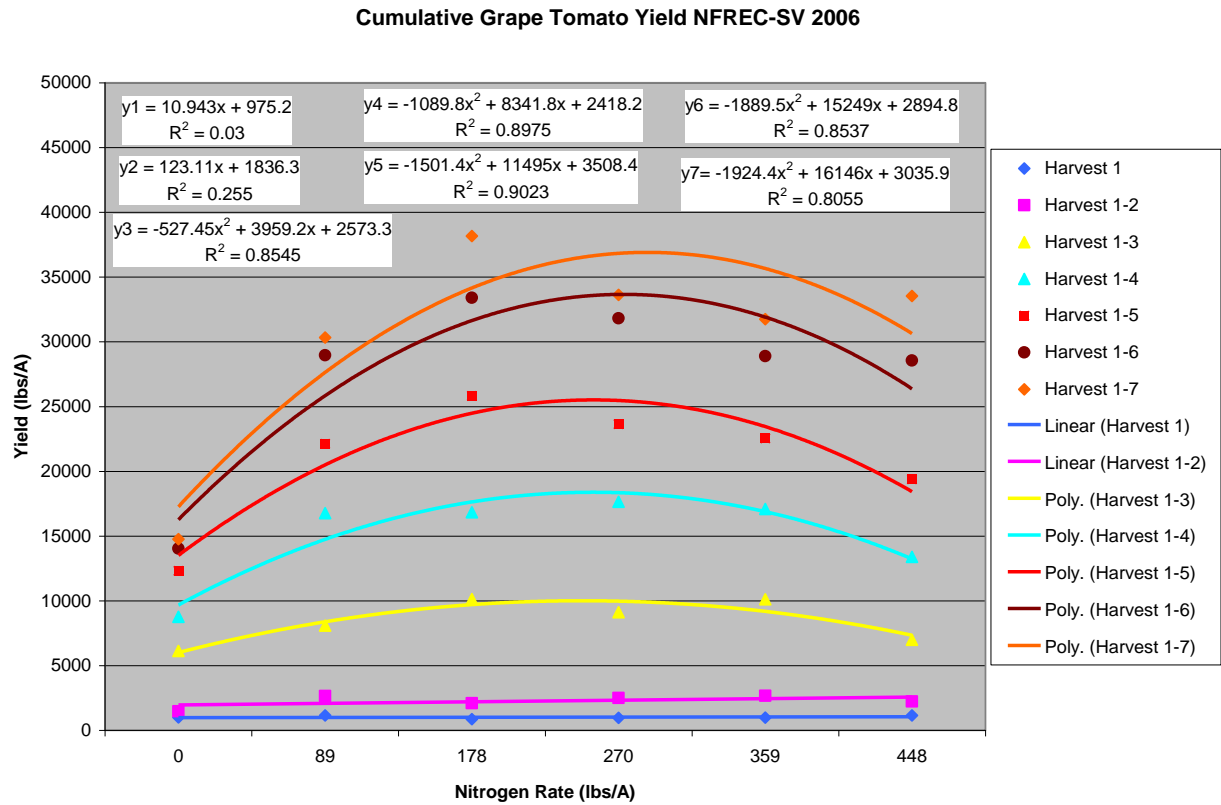


Fig.2. Marketable yield (lbs/A, 7 harvests cumulated) response of ‘Tami G’ grape tomato grown with plasticulture in the Spring of 2006 at the North Florida Research and Education Center- Suwannee Valley, near Live Oak, FL, to nitrogen rates (y1 to y7 represent cumulative yields from up to harvest 1, to up to harvest 7, respectively).

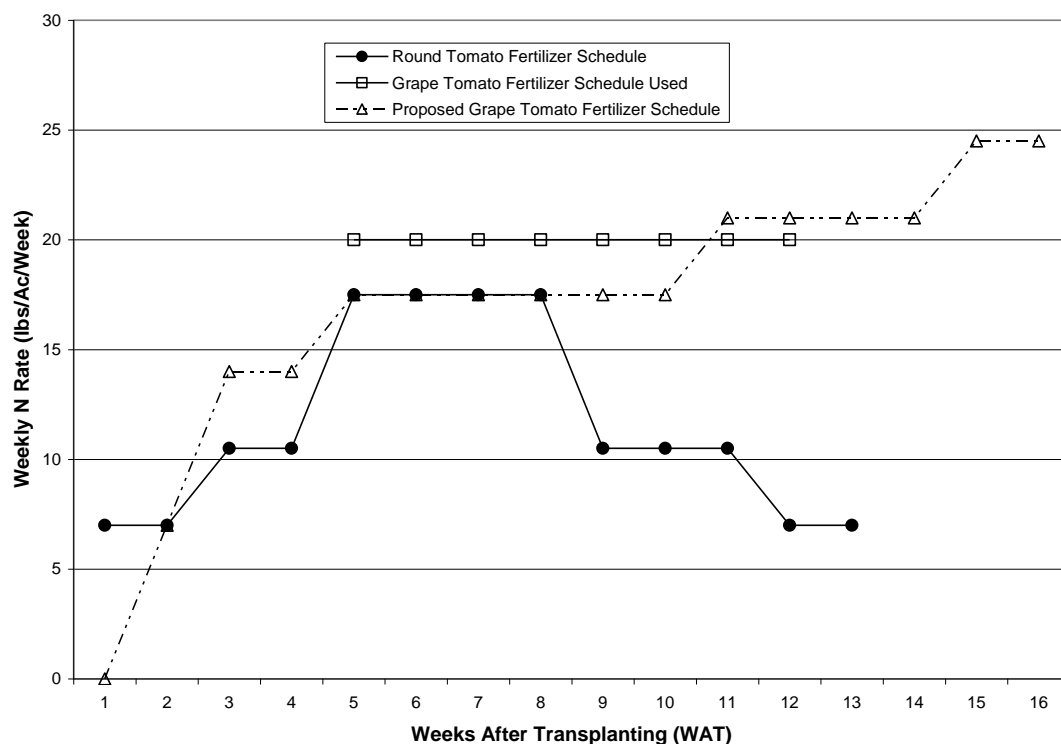


Fig. 3. Comparison of N injection schedules: IFAS recommendations for round tomato (13 weeks), injection schedule used in 2005 and proposed injection schedule for grape tomato

Project 4. Potato Nutrient Management at SVREC

Tom Obreza and Chad Hutchinson

Objective: Investigate N rate and source effects on two white potato varieties under center pivot irrigation.

Fertilizer treatments:

1. Water-soluble N (31-8-0) at 175 lbs/acre, 45 lbs P_2O_5 /acre, 150 lbs K_2O /acre.
2. Potato Blend (39-0-0) at 175 lbs N/acre, 45 lbs P_2O_5 /acre, 150 lbs K_2O /acre.
3. Purcell fertilizer (43-0-0) at 175 lbs N/acre, 45 lbs P_2O_5 /acre, 150 lbs K_2O /acre.
4. IFAS standard at 200 lbs N/acre, 52 lbs P_2O_5 /acre, 150 lbs K_2O /acre using water-soluble fertilizer.
5. High N treatment at 250 lbs N/acre, 65 lbs P_2O_5 /acre, 150 lbs K_2O /acre using water-soluble fertilizer.
6. Untreated check at 0 lbs N/acre, 45 lbs P_2O_5 /acre, 150 lbs K_2O /acre.

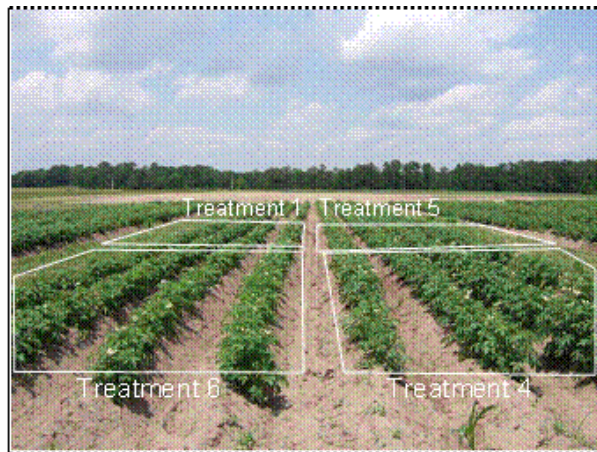
Growing season: Spring 2006

Harvest: June 2006

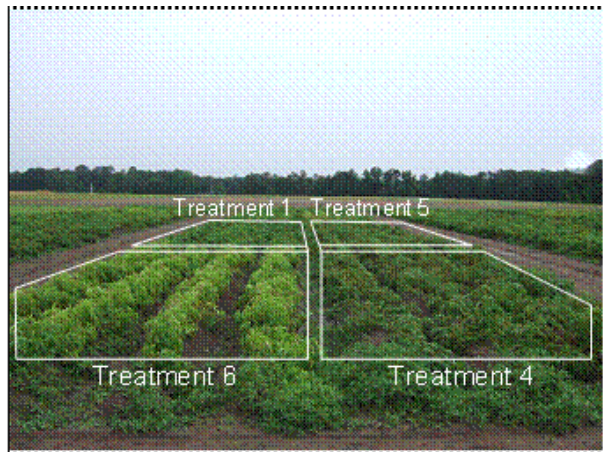
Results:

Significant yield response to N fertilizer compared with the untreated check (Trt. 6).

1. Yields as a percentage of the untreated check treatment: Trt 1 – 120%; Trt 4 – 124%; Trt 5 – 132%. Therefore, not much difference between the IFAS standard N rate and the high N rate, which is closer to the grower standard.
2. Controlled release fertilizer performed poorly in this experiment. Yields as a percentage of the untreated check treatment: Trt 2 – 79%; Trt 3 – 90%.
3. The two white potato varieties responded similarly to N fertilizer rate and source.



April 2006



June 2006

Conclusions:

1. Yields were low across the entire experiment, so we need to evaluate the production system.
2. The IFAS-recommended N fertilizer rate was optimum.
3. We feel the poor performance of the controlled-release materials was due to placement, not the materials themselves. Placement will be improved in future experiments.

Take-home lessons-vegetables:

1. Further work is needed to improve watermelon irrigation scheduling under drip irrigation.
2. Irrigation and N rates for eggplant need further evaluation to obtain optimal yields over the entire season but early season recommendations appear sufficient.
3. Grape tomato production appears to follow round tomato N and irrigation needs in early season but N and irrigation needs are greater, as the season progresses. More verification trials are warranted.
4. Slow release fertilizer placement for potato production needs further evaluation, as well as the production system, in general.

Field days and workshops:

The following Field days and Workshops were carried out at NFREC-Suwannee Valley and Quincy, between December 2005 and December 2006, in support of vegetable nutrient BMPs:

Gwinn Farms Watermelon BMP On-Farm Field Day, 18 May, 2006

Special Vegetable BMP Tour, Agencies and Legislators, NFREC-Suwannee Valley, 23 May, 2006

Twilight Field Day, NFREC-Suwannee Valley, 23 May, 2006

Vegetable Field Day, NFREC-Quincy, 1 June, 2006

Jefferson County BMP/WPS Grower Meeting, Monticello, 24 August, 2006

Fall Workshops, NFREC-Suwannee Valley, 8 November, 2006

FORAGE AND AGRONOMIC CROPS

Co-principal investigators: Cheryl Mackowiak, Randi Randell, Don Graetz, Ann Blount, Cliff Starling

During 2006, a newly automated pivot was installed where the older tobacco pivot had been (see Figure 1). The old pivot was moved to what is commonly referred to as the Lake field and upgrading was completed in late summer to support forage BMP demos and trials.

The forage BMP projects for 2005/2006 included the following:

1. Hay interim N measure demonstration
2. Fertilization demonstration with bahiagrass and bermudagrass
3. Development of large acreage perennial forage demonstrations
4. Overseeding with winter annuals/wildlife food plots
5. Corn silage BMPs

Project 1. Hay interim measure demonstration

Don Graetz, Joel Love, Cliff Starling, Randi Randell

Monitoring of long-term nitrate uptake and leaching losses in a Coastal bermudagrass non-irrigated field continues. In fall 2005, the commonly used oat variety (Coker 227) was overseeded (3 bu/A) early (11/04/05) to get earlier vegetative cover. Approximately 20% of the field was seeded with Horizon 474 (greater disease resistance and higher yielding). March through May, 2006 had only 25% of the rainfall (4.2 inches) compared with the same period in 2005 (17.2 inches). Additionally, a high incidence of *Bipolaris* leaf spot was found on Coker 321 plants. The overall 2006 oat yield was low (50% decline) and nearly 80% of the yield came from the Horizon 474. In fall 2006, Horizon 474 will be planted at 2 bu/A in early December, 2006. Coastal bermudagrass yields were as good or better in 2006 than 2005, except for late summer (Jul/August), where rainfall was nearly 40% less (8.3 inches) than the previous year (13.3 inches). The average yearly N removal efficiency (lb hay/lb N) was similar among years but it is clear to see that early spring resulted in much lower N removal. The winter annual crop appeared even more sensitive to disease and environmental stresses resulting in greatly diminished N removal (Table 1).

Table 1. Harvest history from the past two seasons.

Harvests	2005 Yield (T/A)	2006 Yield (T/A)	2005 N Applied (lb/A)	2006 N Applied (lb/A)	2005 lbs hay per lb N	2006 lbs hay per lb N
Spring	0.5	0.7	85	60	12	23
Mid Summer	1.5	1.7	82	80	37	43
Late Summer	1.5	1.3	83	73	36	36
Early Fall	1.5	1.6	81	80	37	40
Overseed Oats	2.3	1.3	100	127	46	20
Total	7.3	6.6	431	420	34	31

*Not included in totals

Project 2. Fertility study with Tifton-85 bermudagrass and Pensacola bahiagrass

Cheryl Mackowiak and Ann Blount

Treatments:

- A. Check (no fertilizer)
- B. Control (no K, Mg, or S fertilizer)
- C. Low K₂O (IFAS recommendations)
- D. High K₂O (2x IFAS recommendations)
- E. Low K₂O (1/4 K as potassium magnesium sulfate)
- F. High K₂O (1/4 K as potassium magnesium sulfate)

All plots received 100 lbs of N (IFAS recommends 80 lbs) in early spring of the second and third season in addition to post cutting applications to ensure N was non-limiting. Bahiagrass and bermudagrass growth curves in 2005 and 2006 were similar (Figs. 1a, 1b, 1d and 1e). Tissue N in 2005 was much greater in early spring and late fall as growth rate declined, leading to a tissue concentrating effect (Figs. 1c and 1f). Treatments receiving N only had comparable tissue N content to the complete fertilization treatments but biomass declined in 2005 and was even worse in 2006 for the N only treatments. This resulted in lower plant N recovery from N treatments versus N + K +S treatments (Fig. 2). Analysis of the 2006 tissue continues but N recovery trends will likely be similar to or with even greater than the 2005 results. These data emphasize the importance of maintaining adequate plant nutrition to maximize plant utilization of N applications. The 30% or more unutilized N left by the N only treatments is susceptible to soil leaching. Additionally, the data suggest that less N fertilizer may be warranted in early spring and late season (September) in north Florida. However, the same may not hold true for south Florida, where the growing season is longer or in North Florida under irrigation.

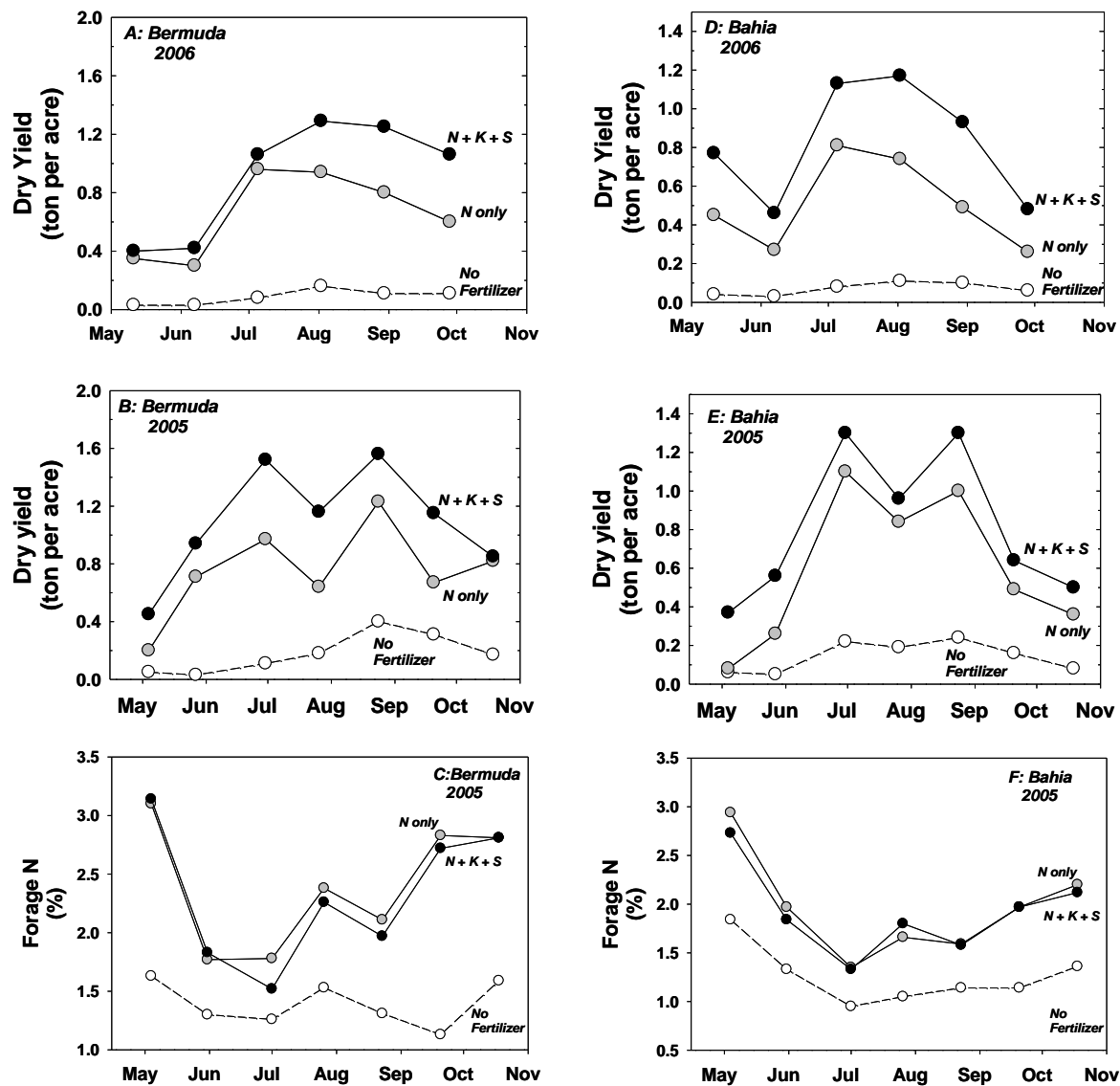


Fig. 1. Fertilization effects on established, non-irrigated bermudagrass and bahiagrass hay fields. Bermudagrass yields for 2006 (A) and 2005 (B) with associated tissue N in 2005 (C). Bahiagrass yields for 2006 (D) and 2005 (E) with associated tissue N in 2005 (F).

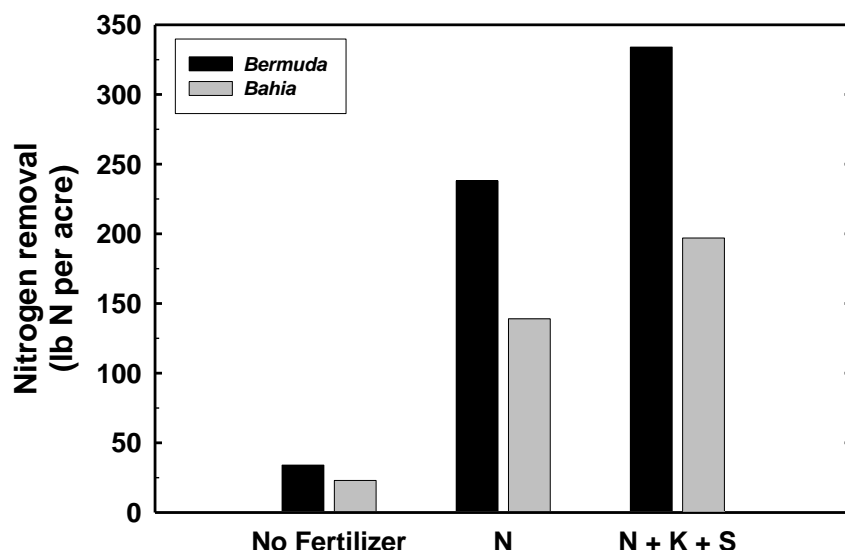


Fig. 2. Fertilization effects on total N removal in bermudagrass and bahiagrass forage in 2005. Nitrogen was added in surplus to N and N + K + S treatments to study K and S effects without N limitation.

Project 3. Development of large acreage perennial forage demonstrations

Randi Randall, Cheryl Mackowiak, Ann Blount

Four bermudagrass cultivars (Russell, Tifton 85, Coastal, and Alicia) that were established on adjoining 1.5-acre fields in 2005 were fertilized twice according to IFAS recommendations and the hay delivered to the IFAS beef unit in Gainesville, FL. Three bahiagrass cultivars (Argentine, Pensacola, and Tifton-9) that were established on adjoining 1.5 acre fields in 2005 were fertilized once according to IFAS recommendations. Seasonal hay yields were not routinely collected in 2006 but Randi Randell procured a permanent weighing device so timely forage removal weights will be collected in 2007.

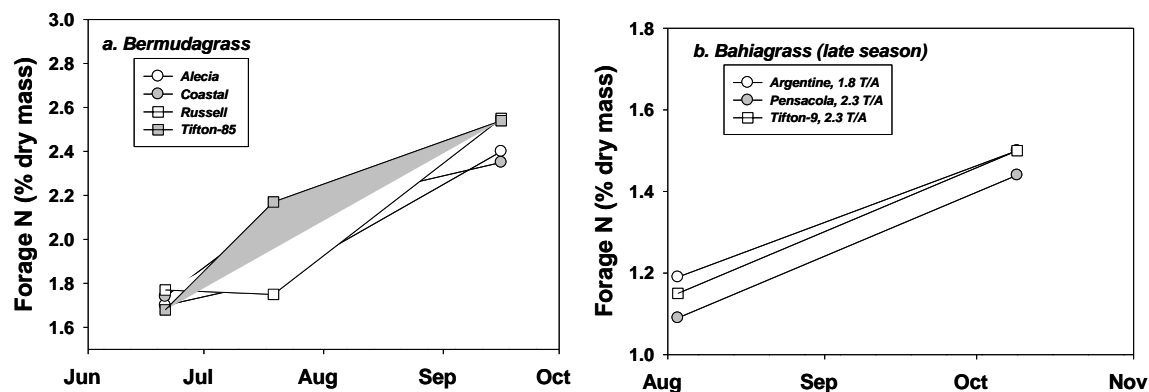


Fig. 3. Perennial forage tissue N content in second establishment year, 2006; a = bermudagrass; b = bahiagrass with late season yield provided in legend box..

In general, tissue N content increased with the season, as improved fertility practices were put into place and as plant growth slowed (Fig. 3a). Increasing forage N content occurred also with

the bahiagrass (Fig. 3b). Late season bahiagrass yields were lowest from Argentine and forage N content was lowest with Pensacola (Fig. 2b). In spring 2007, a bahiagrass cultivar developed by Dr. Ann Blount will be seeded along with the three existing cultivars.

Restoration of four perennial peanut fields (4 cultivars) continued in 2006. Common bermudagrass, sedges and gophers are the biggest challenges to overcome. Some naturally recurring hybrids were discovered on site and vegetative cuttings were taken for evaluation and possible propagation. The public release of cultivar Ecoturf from UF-IFAS will provide an opportunity to showcase this cultivar at Live Oak, where it has existed for several years. Ecoturf makes high quality forage and its somewhat shorter stature, makes it a popular ornamental choice. It has been used in place of turf for some home and commercial landscapes. Use of legumes in place of turf may reduce N fertilization demands.

Project 4. Overseeding with winter annuals/wildlife food plots

Cliff Starling, Chris Vann, Joel Love, Cheryl Mackowiak

An overseeding demonstration was begun in the fall of 2005 to highlight overseeding of winter annual forages and wildlife food plot forages. Forages included rye, triticale, annual ryegrass, oats, clovers and alfalfa. These were drilled into non-irrigated alternating Pensacola/Tifton-85 1-acre strips. Approximately 1 inch of water was used to initiate germination and emergence and IFAS fertilization recommendations were followed. However, following common practice, the forage received no additional irrigation. Rainfall was exceedingly low and therefore stands in all but the triticale looked quite poor. Without a variety of forage species to present the planned field day was postponed until spring of 2007. The legumes, which are sensitive to droughty conditions, were especially stunted and weak. Of the clovers, crimson appeared to survive the best and crimson growing the T-85 strip which traditionally received poultry litter, had plants 3 to 4 times larger than plants growing with commercial mineral fertilizer. Tissue samples were taken for inorganic analysis and results provided in Table 2.

Table 2. Crimson clover forage composition

Sample	N (%)	P (%)	K (%)	Mg (%)	Ca (%)	S (%)	B (ppm)	Zn (ppm)	Mn (ppm)	Fe (ppm)	Cu (ppm)
Mineral	3.08	0.31	1.72	0.32	1.12	0.14	11	34	60	76	10
Litter	3.74	0.27	2.45	0.28	0.83	0.24	18	38	56	75	8
Sufficiency*	3.0-4.5	0.28-0.60	1.8-3.5	0.2-0.6	2.0-2.6	0.26-0.30	30-80	18-80	30-120	30-250	8-15

*Taken from Agronomy Facts, 31-C, <http://cropsoil.psu.edu/extension/facts/agfact31c.pdf>

The poultry litter plants tended to have greater N (better N fixing), K, S and B than the mineral fertilized plants and S, B, and Ca values were below the suggested minimum sufficiency values. Based on the visual symptoms (stunted, pale green plants), S deficiency may have been a partial cause for the lower response using mineral fertilizer. However, it may be that non-nutrient benefits were gained when litter was applied to legumes. Perhaps the litter applications resulted in a more conducive physical environment for N fixation (warmer or moister). We did not see a noticeable grass treatment difference, which also suggests there is not a particular nutrient benefit from the litter treatment.

Wildlife food plots were planted as a demonstration in fall, 2005. The seed treatments are compiled yearly by Drs. Blount and Olson to help show off new forage cultivars and planting mixes. The plots typically garner much interest from the public. Plants in the 2006 plots grew ok but there was not enough variety without the overseeding component to organize a field day around. Trials which will include poultry litter and lime treatments should insure for a successful field day in 2007.

Project 5. Corn Silage Yield Response to Poultry Litter and Inorganic Fertilizer, 2006

Mace Bauer, Cliff Starling, Chris Vann

The intent of this project was:

1. To investigate nitrogen mineralization and nitrogen availability from poultry litter to a corn silage crop.
2. To investigate yield benefits realized from litter applied as an additional nutrient source where IFAS recommended nitrogen rate is being applied through inorganic fertilizer.
3. To investigate the use of chlorophyll meters and tissue testing and their benefit in measuring in-plant nitrogen at different stages of growth and subsequent yields.

Materials and Methods

Corn was planted in 30" wide rows at a seeding rate of 27,000 seeds/acre. At harvest plant population averaged 25,300 plants per acre. Plot size was 12 rows, or 30 ft wide x 36 ft long. There were four replications of each treatment.

Treatments were:

- A. *IFAS recommended rate.* 210# of inorganic fertilizer. 25% applied at planting followed by two side dress applications.
- B. *½ IFAS rate + 2 tons poultry litter.* Poultry litter before planting and incorporated. Approximately 52# of available N according to a manure sample test (2 tons/acre) and 105# of inorganic fertilizer in two side dress applications.
- C. *4 tons poultry litter.* Poultry litter before planting and incorporated. Approximately 105# of available N according to a manure sample test (4 tons/acre). No additional inorganic fertilizer.
- D. *Non-limited.* Poultry litter before planting and incorporated. Approximately 105# of available N according to a manure sample test (4 tons/acre). 210# of inorganic fertilizer. 25% applied at planting followed by two side dress applications.

Discussion

Average yield across all treatments was 25.0 tons/acre. That yield level was consistent with those attainable in this region, and similar to the yields obtained by regional corn silage producers in 2006. The season was remarkably low in rainfall and required high irrigation to reach peak yields, however the lack of rainfall simplified nutrient management as no leaching rain events were experienced.

Treatments effects on corn silage yields were significant ($p > .01$). There were no significant yield differences between Treatments A (mean 29.4 t/ac), B (mean 28.1 t/ac), and D (mean 27.1 t/ac). However, yields of Treatment C (mean 16.4 t/ac) were significantly lower than each other treatment. This finding was not unexpected because the available Nitrogen from treatment C was about 50% of that recommended by the University.

Treatment D was intended to be a “non-limiting” Nitrogen treatment, and had 50% greater available nitrogen than the University recommendation. In this study, the yields obtained using the University of Florida recommended rate of 210 # N/acre (Treatment A) were not significantly different than those obtained using a “non-limiting” nitrogen application.

Additionally, yields obtained in Treatment B were not significantly different than those in the “non-limited” plots. It is difficult to interpret the importance of this comparison within the design of this study. The intent of the study was to determine whether a greater amount of Nitrogen is mineralized in the first year than that indicated by the current manure sample recommendation. This result could indicate that an amount greater than 52# of Nitrogen was mineralized from the manure application in Treatment B. However the interpretation of these results could be that an amount of nitrogen similar to 152#/acre was required to obtain yields similar to that of a “non-limited” nitrogen application.

Yields obtained in Treatment C were significantly lower than those obtained in each of the other treatments. If there were a greater amount of N mineralization occurring than that expressed in a manure sample test recommendation, we may expect to see larger yields than those obtained from the application of 4 tons of manure/acre. However, this was not clearly demonstrated.

Chlorophyll and Tissue Testing

There were significant differences in leaf nitrogen content from the leaf samples obtained at R1. Treatment C had significantly less leaf nitrogen content than all other treatments. There were no significant differences among each of the other treatments. Those results were consistent with the significantly lower yields obtained in treatment C, and no significant differences among each of the other treatments. This was an indicator that nitrogen was a yield limiting factor in treatment C. The leaf nitrogen content required for maximum yields was approximately 3.0%. A quadratic model fit the data well within the range of 2.7-3.1% nitrogen content that was observed in this trial. A quadratic model however, may not be suitable for these data, as the peak of the response curve was not included within the range studied. A linear-plateau model may be more suitable within the range of data observed.

Previous research has shown that SPAD readings within 95% of those obtained in a non-limited plot are suitable for obtaining maximum yields. In this trial, treatment B had a mean SPAD reading 94.4% of those obtained in the non-limited treatment with no significant differences in yield level. Treatment C, which had significantly lower yields had a mean SPAD reading that was 88% of the value obtained in the non-limited treatment. This is an indication that the chlorophyll meter is a tool that may be effective in predicting nitrogen sufficiency for silage corn grown in Florida conditions and that SPAD values 95% of those measured in a “non-limited” plot may be suitable for maximum yields. A linear-plateau model should be considered for these data.

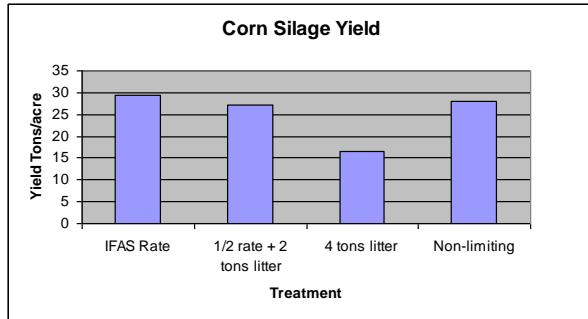


Figure 1. Mean yields.

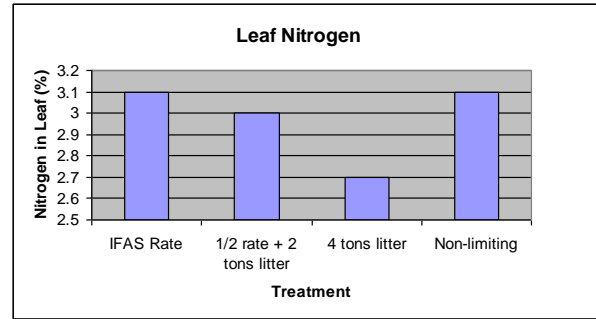


Figure 2. Mean leaf N collected at R1.

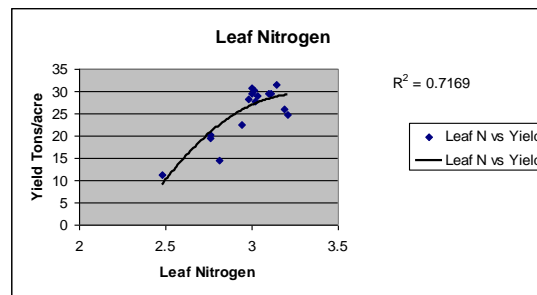


Figure 3. Relationship between leaf N and silage yield.

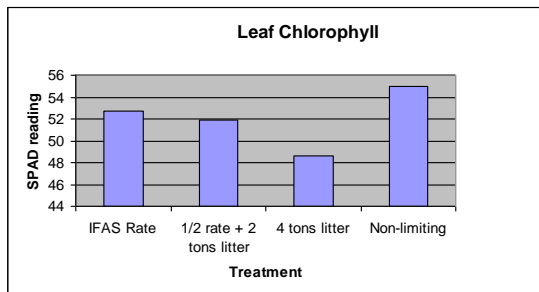


Fig. 4. Mean SPAD readings at R1.

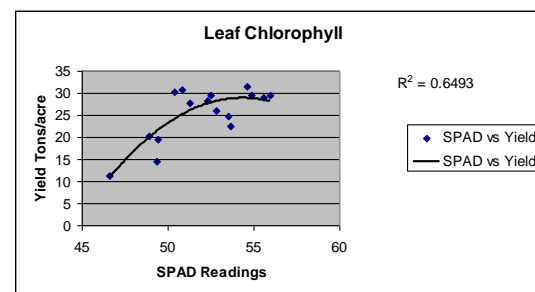


Fig. 5. Relationship between SPAD reading and silage yield.

Take-home lessons:

Forage grasses were much less efficient in utilizing N fertilizer for biomass production in early spring and post August. It should be examined to see if lower application rates during those periods can improve efficiency without compromising yield.

1. Nitrogen uptake losses of more than 30% may occur if other forage nutrients, such as K and S, are limiting. A complete, balanced fertilization program will ensure against N fertilization waste.

2. There are differences in bermudagrass and bahiagrass cultivars as it relates to tissue N and biomass production. This will culminate into differences in N removal and likely N losses.
3. Most winter annuals, except perhaps rye and triticale perform poorly if droughty conditions are present. Poultry litter improved legume growth in a drought situation, which is likely due to it having some effect on the N-fixing environment.
4. Corn silage can grow well if some nutrients are provided by poultry litter (2 T/A). The Minolta SPAD meter was useful at determining N status of the corn silage crop.

Field Days and Workshops:

Beef Cattle short course presentations, Gainesville, 04 May, 2006

Forage BMP In-service training, Gainesville, 16 May, 2006

Twilight Field Day, NFREC-Suwannee Valley, 23 May, 2006

Jackson Farms Silage Corn On-Farm Field Day, Live Oak, 23 June, 2006

Northeast Florida 9th Regional Hay Day, NFREC-Suwannee Valley, 19, July, 2006

Gilchrist County On-Farm Peanut BMP Field Day, 23 August, 2006

Fall Workshop, NFREC-Suwannee Valley, 8 November, 2006

FORESTRY

Co-principal investigators:: Anna Osiecka, Patrick Minogue, and Jerek Nowak

Introduction

The forestry effort was down-scaled in 2006 while UF-IFAS worked to fill the faculty position left vacant by Jerek Nowak's departure. Patrick Minogue began as forestry specialist in November and he has plans to increase BMP development and exposure in this area.

Silviculture Best Management Practices (BMPs, Florida DACS, Division of Forestry, revised in 2004) include the following fertilizer application limits for elemental nitrogen, not to be exceeded during forest fertilization operations:

No more than 1000 lb/A over any 20-year period

No more than 250 lb/A for any 3-year period

No more than 80 lb/A during the first 2-years of newly established plantations

Fertilization is one of the most cost-efficient silvicultural practices, but little is known about the effect of fertilizing southern pines on sandy soils. Large areas of deep sands, with very little soil profile development, exist in the north Florida sandhills, including Suwannee Co. They are classified as class G in the CRIFF (Cooperative Research in Forest Fertilization) forest soil

classification system. These soils are inherently infertile, yet their responsiveness to applied fertilizers is limited due to low sorption capacity. Water deficits generally limit pine productivity and responses to fertilizers on class G soils. Additionally, the potential for leaching causes groundwater contamination concerns, when fertilizing these soils. Therefore, fertilizer applications are generally not recommended for class G soils. However, many plantations in Suwannee Co., managed primarily for pine straw production, are frequently, and in some cases annually, fertilized.

Objective

The long-term Forestry BMP Demonstration Project has been established at NFREC in Live Oak to demonstrate the effects of applying near-maximum BMP-allowable nitrogen rates on the growth of loblolly, slash, and longleaf pines and on nitrate leaching in sandy soils.

Plantation Establishment

Seedlings of loblolly, slash, and longleaf pines were planted in January 2000 in an old bahiagrass pasture on Foxworth Fine Sand (CRIFF soil class G), at 7 x 10 ft spacing. From 2000 through 2005, herbaceous competition was controlled by herbicides and mowing between the rows of trees. Prior to study initiation the study site was fertilized in 2002.

Treatments

Two fertilization treatments are being compared:

1. Control - no fertilization
2. Mineral fertilizer at the rates approaching the maximum Silviculture BMPs-allowable rates for nitrogen, according to the following schedule:

60 lb/A N in 2005

100 lb/A N every other year beginning in 2007 and ending in 2021.

On May 12th, 2005 mineral fertilizer (Ammonium Nitrate, Ammonium Sulfate, Muriate of Potash, Magnesium Sulfate, Borax, Copper Sulfate, Copper Oxide, Manganous Sulfate, Manganous Oxide, Zinc Sulfate, Zinc Oxide) at the rate of 385 lbs/A was broadcasted with the use of a tractor-drawn commercial fertilizer spreader. As a result, besides 60 lb/A of Nitrogen, the following additional nutrients were supplied: K₂O (60 lb/A), Mg (20 lb/A), S (15 lb/A), B (1 lb/A), Cu (3 lb/A), Mn (3 lb/A), Zn (1 lb/A).

Data Collection

Two suction lysimeters were installed at each depth: 1 ft & 4 ft below the soil surface in each treatment and each species. 30-foot deep monitoring wells were installed in fertilized (well 1 and 2) and unfertilized (well 3) areas. Soil solution samples from lysimeters and surficial ground water samples from wells will be collected for approximately one year following each fertilizer application. Tree height and diameter will be measured during dormancy following each growing season.

In 2005, soil solution and well water samples were collected at 2-weeks intervals from May (one week before fertilizer application) through November, and at 4-weeks intervals from December to May 2006. The nitrate-nitrite nitrogen concentration of the samples was determined by semi-automated colorimetry, according to the EPA method 353.2 at the University of Florida, IFAS,

Analytical Research Laboratory (ARL) in Gainesville. Total tree height and basal tree diameter were measured in January 2005 and January 2006.

Results

There was no fertilizer effect on tree height or diameter of any species during the first year following fertilizer application in May 2005 (Fig. 1 and 2). Nitrate-nitrite nitrogen concentration in soil solution at 1 foot below the soil surface reached a peak (of approximately 50 fold or more that of control) 3 weeks after fertilizer application, in the case of all three species (Fig. 3-5). For loblolly, we did not observe an increase in the nitrate-nitrite nitrogen concentration in soil solution at 4 feet during the year following fertilization (Fig. 4). On the other hand, we did record elevated levels of nitrate-nitrite nitrogen in soil solution at 4 feet, in the case of slash & longleaf pines, beginning 9-11 weeks after fertilization (Fig. 4, 5). This indicates a flux of nitrates through soil profile under these two species. For both species, the maximum concentration of nitrate-nitrite nitrogen concentration in soil solution collected at 4 feet was much lower than the maximum concentration at 1 foot.

Fig. 1 Height and Diameter Increase from Jan. 2005 to Jan. 2006

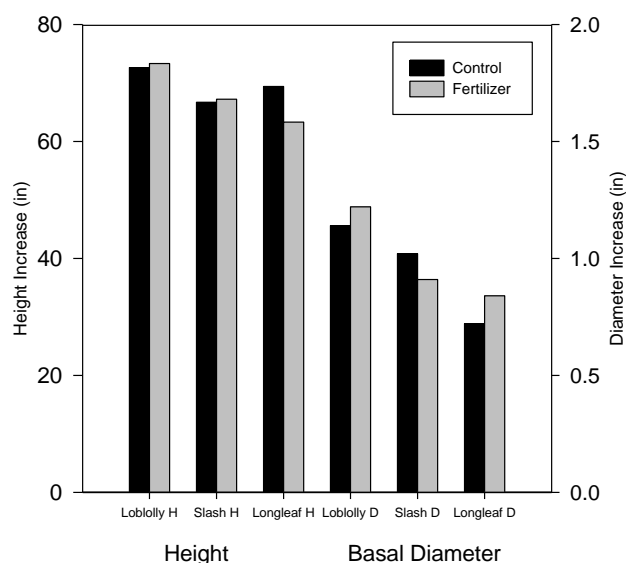
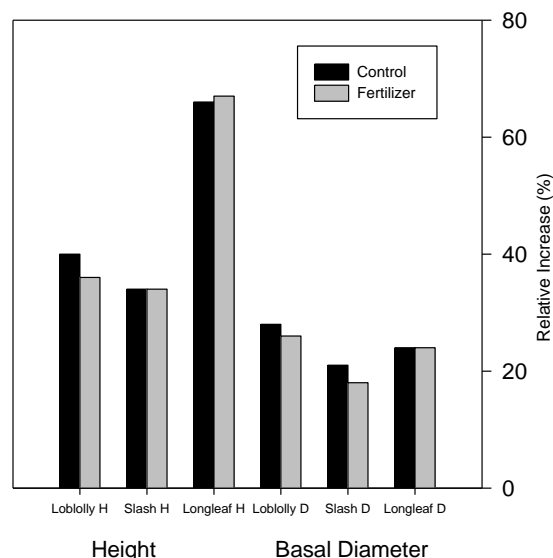


Fig. 2 Relative Height and Diameter Increase from Jan. 2005 to Jan. 2006



Following fertilization, nitrate-nitrite nitrogen concentration was slightly elevated in well # 2 water, for two sampling dates, and more consistently in well # 1 water, as compared to control - well # 3 water (Fig. 6). The concentration fluctuations may be attributed to both, vertical and horizontal water movement.

Fig. 3 Nitrate-Nitrite Concentration in Soil Solution at 1 & 4 feet depths in Loblolly Pine

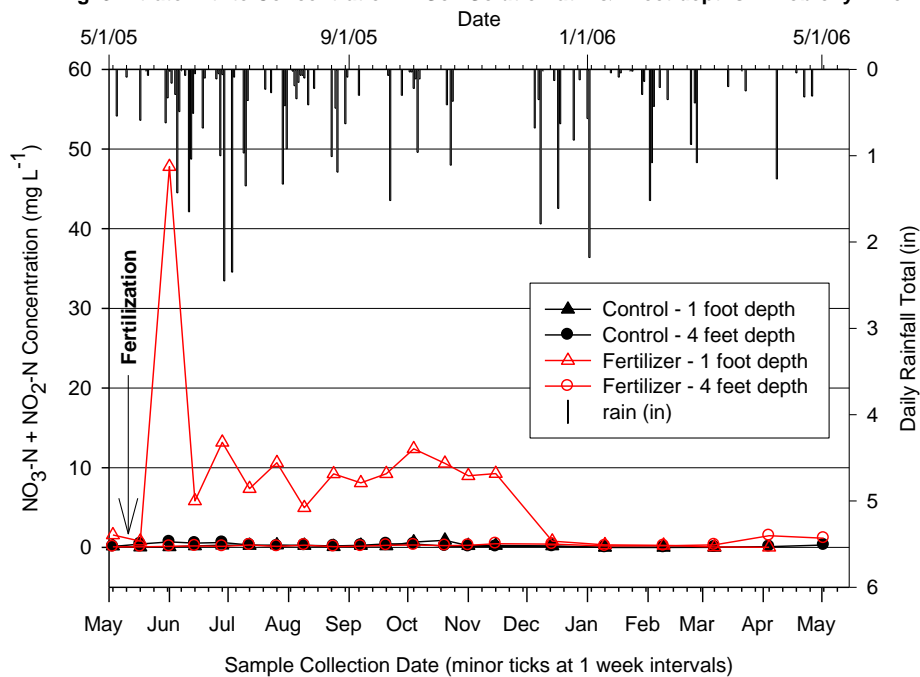


Fig. 4 Nitrate-Nitrite Concentration in Soil Solution at 1 & 4 feet depths in Slash Pine

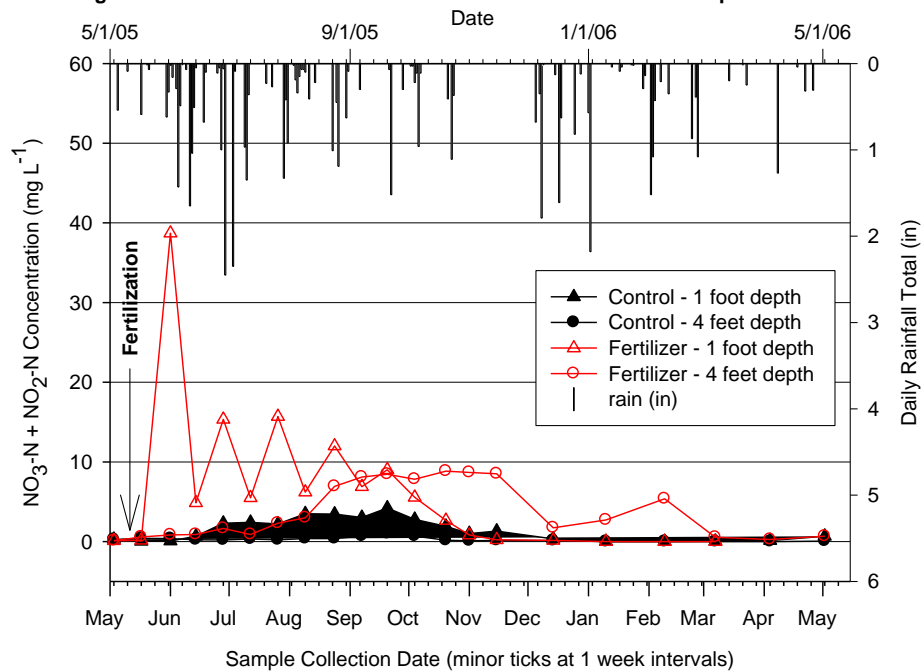


Fig. 5 Nitrate-Nitrite Concentration in Soil Solution at 1 & 4 feet depths in Longleaf Pine

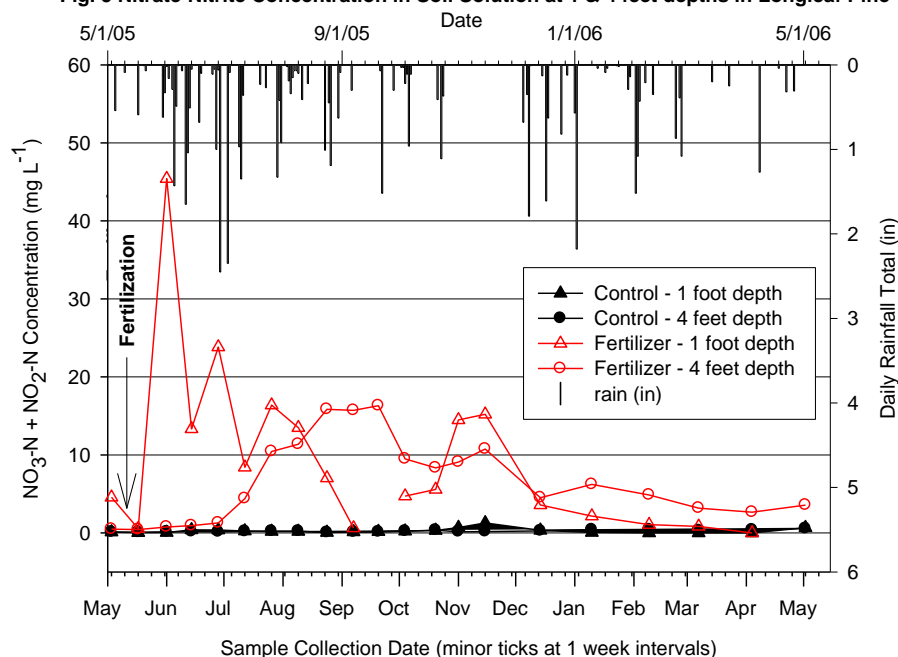
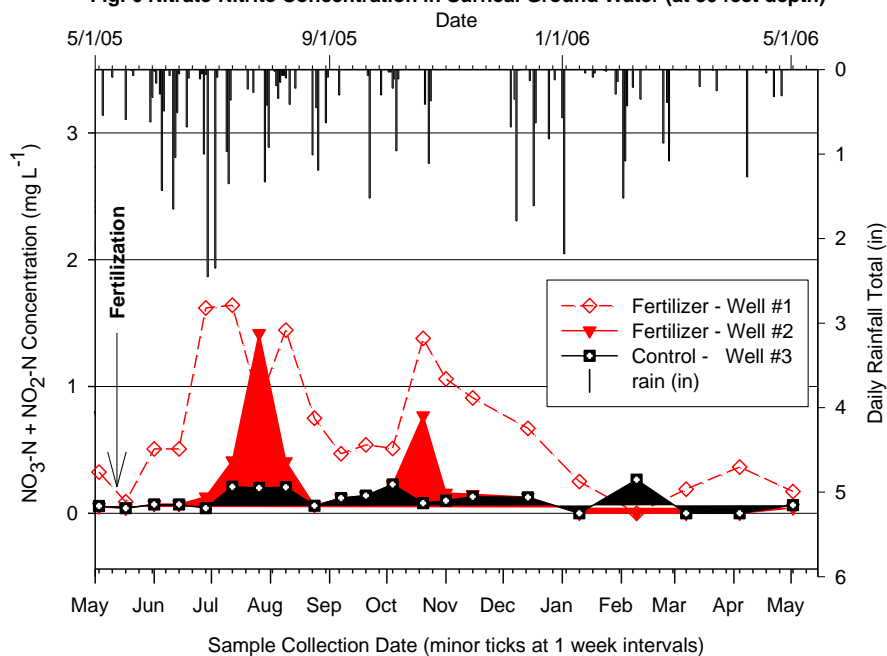


Fig. 6 Nitrate-Nitrite Concentration in Surficial Ground Water (at 30 feet depth)



Take – home lessons:

1. There was no fertilizer effect on height or diameter growth of loblolly, slash or longleaf pines during the first growing season following application. This does not preclude a long-term effect, since typically pines initially respond to fertilizer by enhanced crown growth, which in turn results in greater wood production

2. A big spike in nitrate-nitrite nitrogen concentration in soil solution at 1 foot below soil surface occurred within 3 weeks after fertilization in all three species.
3. We observed nitrate movement 4 feet down the soil profile in the case of slash and longleaf pines. The maximum concentration at 4 feet was much lower than the maximum concentration at 1 foot.
4. We did not observe such a movement in the case of loblolly pine. This may indicate that loblolly removes nutrients from the soil more effectively than slash or longleaf. It is generally known to respond to fertilization better than the other two species, and has a larger crown.
5. A slight, temporary increase in nitrate-nitrite nitrogen concentration in surficial ground water could be attributed to fertilization and, possibly, to horizontal water movement. The highest recorded concentration was 1.64 mg L^{-1} , only a fraction of the EPA standard for drinking water (10 mg L^{-1}).

Field Days and Workshops:

Twilight Field Day, NFREC-Suwannee Valley, 23 May, 2006